

This procedure is designed to test a fully assembled ASP-1 instrument. It is written specifically to apply to a newly manufactured ASP-1, containing a pretested circuit board assembly (tested per 10429-A394) and a pretested meter (tested per 10429-A395).

If other conditions exist, a complete checkout, beginning with 10429-A394 (including the meter linearity test on range switch position 2), may be in order.

A. Equipment Required:

1. DVM, FLUKE 8020A, Typical.
2. High voltage probe for DVM.
3. Minipulser, MP-1 or MP-2.

B. Preliminary:

1. The ASP-1 cans are serialized on the calibration label. Do not switch cans. (Check that the labels are in place in the can and that the S/N is written on the calibration label.)
2. Set the ASP-1 range switch to OFF.
3. Install the units label above the meter according to the information available from the Job Order, Shipping Order, Purchase Order or instructions from Sales. (For internal detector, use mR/h.)

If multiple detectors are ordered and no definite instructions become available, estimate which detector will be used the most, check out the other detectors first and then configure the ASP-1 for shipment with the most popular detector. Include a calibration certificate for only the final configuration.

If no detector is ordered and no other information is available, set up the ASP-1 as if it were to be used with an HP-270, mR/h. If the detector to be used with the ASP-1 is specified but no information is available as to the desired readout units, set up as directed in the individual detector instructions.

4. Set the range switch dial plate so that the proper multipliers are visible. See individual detector/units pages.
5. Check the meter mechanical zero. Set to within one needle width, horizontal plane. If batteries are installed, only the front center battery need be removed to reach the adjusting screw.
6. Make sure the meter light lamps (on the PC board) are upright, leads not twisted and that no wiring or other objects obstruct the light. Press the blue (shielded) HV feedback resistor (R12) against the HV transformer.
7. If an internal detector is installed in the ASP-1, turn the HV ADJ pot fully CCW to prevent an

overvoltage to the GM tube.

8. Set the "Test-Run" switch to "Run."
9. Install the batteries.

C. 5V Check

1. Connect a DVM between the HV transformer frame (-) and +5V at the outside end of R5, beside the crystal can. (+5V can also be found at the outside ends of R124 and R131, near the right front hex spacer.)
2. Set the range switch to BAT. Read battery voltage on the ASP-1 meter. (Must be above .86, if new.)
3. Read 5.00 to 5.01 on the DVM. If not, adjust 5V pot.
4. Check the quality of the meter lighting. Make sure no shadows appear on scale.
5. Disconnect the DVM (+) lead from the 5V point.

D. HV Calibration Check

1. Connect the HV probe to the ASP-1 HV teflon standoff, referenced to ground at the HV transformer frame. Connect the probe to the DVM.
2. Set the range switch to HV.
 - a. If an internal detector is installed, adjust HV ADJ pot for 550V on the DVM. Adjust, if necessary, HV CAL for 550V on the ASP-1 meter, also.
 - b. If no detector is installed, adjust HV ADJ for 900V on the DVM. Adjust, if necessary, HV CAL for 900V on the ASP-1 meter, also.
3. Disconnect the HV probe.

E. Minipulser Test

1. Connect a MP-1 or MP-2 to the detector connector. For internal detector, connect to the teflon HV standoff, reference to the transformer frame.
2. Set ASP-1:
 - a. Range switch to position 2. (Pos 1 is full cw.)
 - b. Response switch to SLOW.

- c. SPEAKER ON.
 - d. Speaker divider, close "1" only.
 - e. Set PHA-GROSS switch to GROSS if PHA is installed.
3. Set MP
- a. 20 to 30 mV output.
 - b. 1K CPM (or other, to get reading in upper half of meter)
4. Check speaker ON/OFF function. Set OFF.
5. Set MP to MANUAL. While needle is moving toward zero, select SLOW and FAST alternately to prove the slow/fast function.
6. Leave MP connected to ASP-1.

F. Final Calibration

Turn to the section appropriate to the specified setup. (Detector/rate units combination, internal detector, PHA, no detector, etc.)

Section		Sheet
F.1.	Internal Detector	5
F.2.	PHA, LEG-1, SPA-2 1 X 1, SPA-3	9
F.3.	AC-3-7, AC-3-8	17
F.15.	HP-100	83
F.4.	HP-190A	22
F.5.	HP-210 (all types), HP-260, HP-360	27
F.17.	HP-220A	94
F.6.	HP-270	33
F.7.	HP-290	40
F.8.	LEG-1	49
F.9.	NRD	53
F.13.	PG-2	77
F.16.	SPA-1A	89
F.10.	SPA-2, 1X1 Crystal	65
F.11.	SPA-3	69
F.12.	SPA-6	73
F.14.	SPA-8	79
APPENDIX A	ASP-1 without detector and miscellaneous information	A1

F.1. Internal Detector

Perform a. and b. below if calibrating in mR/h. Use c. and d. if calibrating in mSv/h.

a. Preset, Precalibrate

1. Meter label: "INTERNAL GM" below, "mR/h" on top
2. Multiplier dial: X100K-X1 dial
3. Dead time, 14 μ sec.: 2, 4, and 8 μ sec. (only) closed
4. Time switches: MIN open, HOUR closed
5. Calibration switches: 3 closed, 4 open
6. Speaker dividers: 1 (only) closed
7. HV: 550 volts
8. Standard current: .59 (SLOW or FAST, range 1-6, RESET for 5 seconds.)
9. Input sens, THRSH adj.: 10 mV, MP-1 or MP-2 (GAIN full cw)

b. Calibration to Source

1. Calibrate with can installed, on a well cart. Subtract 5 cm from the well setting to account for detector spacing.
2. Take reading in 500 Mr/h field. Note how much adjustment in meter reading is needed.
3. Remove ASP-1 from well, obtain standard current and adjust the CAL pot to move the needle up or down the required amount.

CAUTION: The standard current must not be below 0.42.

4. Recheck in 500 mR/h field. Repeat CAL adjust if necessary.
5. Note reading in 25 R/h field. Remove from field. If higher reading was needed, increase dead time value, and vice versa, and recheck.
6. Run the linearity tests shown on the certificate of calibration. If necessary, the dead time value may be changed to adjust the higher field readings. Check over-range. (It is not necessary to integrate twice. Simply move the range switch for the second reading.)
7. When the readings are all within limits, including the over-range point (40 to 60 R/h) record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
8. Fill in the first line of the calibration record label inside the can. Write "INTERNAL" in probe column. Make sure the S/N is recorded on the label.

F.1. Internal Detector (Continued)

Perform a. and b. below if calibrating in mR/h. Use c. and d. if calibrating in mSv/h.

c. Preset, Precalibrate

- | | |
|------------------------------|---|
| 1. Meter label: | "INTERNAL GM" below, "mSv/h" on top |
| 2. Multiplier dial: | X1K-X.01 dial |
| 3. Dead time, 14 μ sec.: | 2, 4, and 8 μ sec. (only) closed |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 (only) closed |
| 7. HV: | 550 volts |
| 8. Standard current: | .59 (SLOW or FAST, range 1-6, RESET for 5 seconds.) |
| 9. Input sens, THRSH adj.: | 10 mV, MP-1 or MP-2 (GAIN full cw) |

d. Calibration to Source

1. Calibrate with can installed, on a well cart. Subtract 5 cm from the well setting to account for detector spacing.
2. Take reading in 500 mR/h field. Note how much adjustment in meter reading is needed. Reading to be 5 mSv/h.
3. Remove ASP-1 from well, obtain standard current and adjust the CAL pot to move the needle up or down the required amount.

CAUTION: The standard current must not be below 0.42.

4. Recheck in 500 mR/h field. Repeat CAL adjust if necessary. Reading 5 mSv/h.
5. Note reading in 25 R/h field. Remove from field. If higher reading was needed, increase dead time value, and vice versa, and recheck. Reading 0.2 x 1K mSv/h.
6. Run the linearity tests shown on the certificate of calibration. If necessary, the dead time value may be changed to adjust the higher field readings. Check over-range. (It is not necessary to integrate twice. Simply move the range switch for the second reading.)
7. When the readings are all within limits, including the over-range point (40 to 60 R/h field, reading .4 to .6K mSv/h) record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
8. Fill in the first line of the calibration record label inside the can. Write "INTERNAL" in probe column. Make sure the S/N is recorded on the label.

mR/h calibration sheet

mSv/h calibration sheet

F.2. PHA Installed

Unless otherwise specified, use units of CPM when PHA is installed. The data for CPS is also given here in case that its called for. If any other units are specified, specific set up instructions are required from the customer.

a. CPM Preset, Precalibrate (Skip if CPS is used).

- | | |
|----------------------------|--|
| 1. Meter label: | PHA below, CPM on top. |
| 2. Multiplier dial: | X10M-X100 |
| 3. Dead time: | Zero. All DT switches open. |
| 4. Time switches: | MIN closed, HOUR open. |
| 5. Calibration switches: | 3 closed, 4 open. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 400V, approximately |
| 8. PHA-Gross switch: | GROSS |
| 9. ASP-1 range switch: | X10K |
| 10. Set MP CPM: | 8K |
| 11. Set MP amplitude: | 10 mV |
| 12. Set THRESH pot: | Full cw |
| 13. Set GAIN pot: | Set at crossover point. |
| 14. Set MP amplitude: | 15 mV |
| 15. Set PHA-GROSS | PHA |
| 16. WIN pot: | Set at crossover point. (50 percent window.) |
| 17. Set MP amplitude: | 1.5V. Observe no counts. |
| 18. Set MP amplitude: | 12 mV |
| 19. ASP-1 response switch: | SLOW |
| 20. ASP-1 CAL pot: | Set for 8K on meter. |

* CAUTION: The standard current must not be below 0.42.

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|--------------------------------------|------------------------------------|
| 21. ASP-1 response: | INTEGRATE. |
| 22. RESET, time for 30 sec: | Meter reads 4K $\pm$ 1 small div. |
| 23. Response: | SLOW or FAST, as preferred. |
| 24. MP CPM 80, ASP-1
range X100: | Read 80 CPM, $\pm$ 1 small div. |
| 25. MP 800, range X1K: | Read 800 CPM, $\pm$ 1 small div. |
| 26. MP 80K, range X100K: | Read 80K CPM, $\pm$ 1 small div. |
| 27. MP 800K, range X1M: | Read 810K cpm, $\pm$ 1 small div. |
| 28. MP 1.6M, range X10M: | Read 1.65M CPM, $\pm$ 1 small div. |
| 29. Dead time switch 36
(32 + 4): | Over-range |
| 30. ASP-1: | OFF |
| 31. Disconnect MP. | |

Skip b (CPS) and go to c, d, or e, as appropriate.

b. CPS Preset, Precalibrate

- | | |
|----------------------------|---|
| 1. Meter label: | PHA below, CPS on top |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time: | Zero. All DT switches open. |
| 4. Time switches: | Both MIN and HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 400V approximately |
| 8. PHA-GROSS switch: | GROSS |
| 9. ASP-1 range switch: | X100 |
| 10. Set MP CPM: | 4K CPM |
| 11. Set MP amplitude: | 10 mV |
| 12. Set THRESH pot: | Full cw |
| 13. Set GAIN pot: | Set at crossover point. |
| 14. Set MP amplitude: | 15 mV |
| 15. Set PHA-GROSS: | PHA |
| 16. WIN pot: | Set at crossover point (50 percent window). |
| 17. Set MP amplitude: | 1.5V. Observe no counts. |
| 18. Set MP amplitude: | 12 mV |
| 19. ASP-1 response switch: | SLOW |
| 20. ASP-1 CAL pot: | Set for 67 on meter. |

*CAUTION: The standard current must not be below 0.42.

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|---------------------------------|---|
| 21. ASP-1 response: | INTEGRATE. |
| 22. RESET, time for 30 sec: | Read 2K on range X10K, ± 1 small div. |
| 23. Response: | SLOW or FAST, as preferred. |
| 24. MP CPM 40, ASP-1 range X1: | Read .67 CPS, ± 1 small div. |
| 25. MP 400, range X10: | Read 6.7 CPS, ± 1 small div. |
| 26. MP 40K, range X1K: | Read 670 CPS, ± 1 small div. |
| 27. MP 400K, range X10K: | Read 6.7K CPS, ± 1 small div. |
| 28. MP 1.6M, range X100K: | Read 27K CPS, ± 1 small div. |
| 29. Dead time switch 36 (32+4): | Over-range |
| 30. ASP-1: | OFF |
| 31. Disconnect MP. | |

Proceed to c, d, or e, as appropriate.

c. LEG-1/PHA Set Up

Unless otherwise required, set up the ASP-1/LEG-1/PHA as follows:

1. PHA-GROSS switch to PHA.
2. Dead time switches: 8 μ sec. only.
3. Connect the LEG-1 to the ASP-1.
4. Place the ²³⁹Pu source, called for in the calibration certificate against the face of the LEG-1.
5. If the ASP-1 is counting, reduce the HV.
6. Slowly bring up the HV. Observe and record the readings and the HV locations of two distinct peaks and the valley between them. (The first peak found is 60 KeV and the second one is 17 KeV.)
7. Divide the valley reading by each peak reading. If the results are both less than .33, the set up is acceptable.
8. Select GROSS, observe an increase, and reselect PHA.
9. Set HV for the first (60 KeV) peak.
10. Remove the source. Reading will decrease.
11. Observe and record the ASP-1 standard current (SLOW or FAST, RESET for 5 seconds.)
12. Fill in the first line of the calibration record label inside the can. Write LEG-1/PHA in the probe column. Make sure the ASP-1 S/N is recorded on the label.
13. Fill in the rest of the ASP-1/LEG-1/PHA calibration certificate. The "Rate Units" blank is CPM or CPS. The "WINDOW" blank is in percent. (50 percent, in this case.) Fill in the "Dial" blank with X10M-X100 for CPM, X100K-X1 for CPS.

d. 1 X 1 NaI Crystal/PHA Set Up

Unless otherwise required, set up the ASP-1/1 X 1/PHA as follows:

1. PHA-GROSS to GROSS
2. Dead time to 12 μ sec. (4 + 8)
3. Connect the detector to the ASP-1.
4. Expose the detector to a CS-7A check source. (Approximately 1 inch away.)
5. Locate the approximate center of a voltage plateau and move the check source for a reading between 300K and 400K CPM. (5000 and 6500 CPS.) Note the reading.
6. Set PHA-GROSS to PHA. Note the reading and divide it by the plateau count rate. The result must be 0.05 or less.
7. Starting from a low HV, find the first PHA peak reading. Note the reading and the HV.
8. Slowly increase the HV and locate the first valley point. Note the reading.
9. Divide the valley count rate (8. above) by the peak count rate (7. above). The result must be 0.68 or less.
10. Select GROSS, observe increase, and reselect PHA.
11. Set HV back to the first peak value.
12. Remove the source. Reading will decrease.
13. Observe and record the ASP-1 standard current (SLOW or FAST, RESET for 5 seconds).
14. Fill in the first line of the calibration record label located in the can. Write "(model no.)/PHA" in the probe column. Make sure the ASP-1 S/N is recorded on the label.
15. Fill in the rest of the ASP-1/(model no.)/PHA calibration certificate. The "Rate Units" blank is CPM or CPS. The "WINDOW" blank is in percent. (50 percent in this case.) Fill in the "Dial" blank with X10M - X100 for CPM, X100K - X1 for CPS.

e. SPA-3/PHA Set Up

Unless otherwise required, set up the ASP-1/SPA-3/PHA as follows:

1. PHA-GROSS to GROSS.
 2. Dead time to 14 μ sec. (2 + 4 + 8)
 3. Connect the SPA-3 to the ASP-1.
 4. Expose the SPA-3 to a CS-7A (^{137}Cs) check source. (Approximately 3 inches away.)
 5. Locate the approximate center of a voltage plateau and move the check source for a reading between 300K and 400K CPM. (5000 and 6500 CPS.) Note the reading.
 6. Switch to PHA position. Note the reading and divide it by the plateau count rate. The result must be 0.05 or less.
 7. Starting from a low HV, find the first PHA peak reading. Note the reading and the HV.
 8. Slowly increase the HV and locate the first valley point. (Small HV increments may be necessary to locate this low point.) Note the reading.
 9. Divide the valley count rate (8 above) by the peak count rate (7 above). The result must be 0.45 or less.
 10. Select GROSS, observe increase, and reselect PHA.
 11. Set HV back to the first peak value.
 12. Remove the source. Reading will decrease.
 13. Observe and record the ASP-1 standard current (SLOW or FAST, RESET for 5 seconds).
- *CAUTION: The standard current must not be below 0.42.
14. Fill in the first line of the calibration record label located in the can. Write "SPA-3/PHA" in the probe column. Make sure the ASP-1 S/N is recorded on the label.
 15. Fill in the rest of the ASP-1/SPA-3/PHA calibration certificate. The "Rate Units" blank is CPM or CPS. The "WINDOW" blank is in percent. (50 percent in this case.) Fill in the "Dial" blank with X10M - X100 for CPM, X100K - X1 for CPS.

F.3. AC-3-7/AC-3-8

Unless otherwise specified, calibrate in CPM to indicate the 2π value of the source.

a. If CPM is to be used, preset and precalibrate as follows: (Skip to b. if CPS is used.)

- | | |
|----------------------------|-------------------------------------|
| 1. Meter label: | CPM |
| 2. Multiplier dial: | X10M-X100 |
| 3. Dead time switches: | 6 (2 and 4) |
| 4. Time switches: | MIN closed, HOUR open. |
| 5. Calibration switches: | 3 closed, 4 open. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | Not over 1000V. |
| 8. ASP-1 range switch: | X10K |
| 9. Set MP CPM: | 8K |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV. Observe no counts increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 8K on meter. |

*CAUTION: The standard current must not be below 0.42.

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|----------------------------------|-----------------------------------|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Meter reads $4K \pm 1$ small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 80, ASP-1 range X100: | Read 80 CPM, ± 1 small div. |
| 21. MP 800, range X1K: | Read 800 CPM, ± 1 small div. |
| 22. MP 80K, range X100K: | Read 81K CPM, ± 1 small div. |
| 23. MP 800K, range X1M: | Read 870K cpm, ± 1 small div. |
| 24. MP 1.6M, range X10M: | Read 1.9M CPM, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | Leave 2 and 4 closed |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

Skip b (CPS) and go to c.

b. If CPS is to be used, preset and precalibrate as follows:

- | | |
|----------------------------|------------------------------------|
| 1. Meter label: | CPS |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 6 (2 and 4) |
| 4. Time switches: | Both MIN and HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 67 on meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--------------------------------|---|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Read 2K on range X10K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 40, ASP-1 range X1: | Read .67 CPS, ± 1 small div. |
| 21. MP 400, range X10: | Read 6.7 CPS, ± 1 small div. |
| 22. MP 40K, range X1K: | Read 670 CPS, ± 1 small div. |
| 23. MP 400K, range X10K: | Read 6.9K CPS, ± 1 small div. |
| 24. MP 1.6M, range X100K: | Read 31.7K CPS, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | Leave 2 and 4 closed |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

- c. Calibration to Alpha sources. (All sources are to be ^{239}Pu in S94 type source holders except when multiple sources preclude this.)
1. Connect the AC-3- to the ASP-1.
 2. Expose the AC-3 to a 10K to 60K CPM source. Set the ASP-1 to an appropriate range and find the end points of the voltage plateau. Set the HV accordingly, at about one quarter of the way up from the knee.
 3. Using a source in the 10K to 60K 2π CPM range, compute the efficiency of the detector by dividing the ASP-1 reading (CPM or CPS) by the 2π source value (in CPM or CPS). The result must be greater than .28, AC-3-7, and greater than .18, AC-3-8.
 4. Place sources P1955, P478 and S1071 ($1.11\text{M} + 1.57\text{M} + 2.76\text{M} = 5.44\text{M}$ 2π source CPM) under the detector. Multiply 5.44M CPM (90.67K CPS) times the efficiency value computed in 3 above. Expose the source to the detector and set the dead time switches for a reading on the ASP-1 equal to the CPM or CPS computed. The dead time should be from 6 to 16 μsec .
 5. Expose the detector to the sources indicated on the calibration certificate. If the final calibration is to true detector count rate, record the range switch settings and the count rates (CPM or CPS) on the calibration certificate. Compute and record the percent efficiencies for all sources, regardless of the final calibration. (Percent efficiency = ASP-1 reading X100 divided by the 2π source value.) The minimum efficiency for each source is 28 percent, AC-3-7 and 18 percent, AC-3-8. Each one should be within 10 percent of the average efficiency value.
 6. If the calibration is to true detector count rate, check the appropriate box (upper one) on the calibration certificate. Skip to number 12 below.
 7. If the calibration is to 2π source value, check the appropriate box (lower one) on the calibration certificate. Connect the minipulser to the ASP-1.
 8. Set the ASP-1 range switch to position 3. (Position 1 is fully CW.) Set the CPM output for a reading between mid and full scale.
 9. Compute the average of the percent efficiencies on the calibration certificate and divide by 100 to get a decimal efficiency number.

10. Divide the ASP-1 reading of 8. above by the decimal efficiency. Do not change the minipulser frequency but calibrate the ASP-1 to read the higher count rate. Use the minimum possible settings of the cal switches, 3 and 4.

CAUTION: The standard current must not be below 0.42

11. Reconnect the detector and retake the readings from the sources listed on the calibration certificate. The readings must be within 10 percent of the 2π source values. Record the range switch settings and the readings on the calibration certificate.
12. Fill in the remaining blanks on the certificate. (The rate units blank is CPM or CPS.) Sign and date it.
13. Fill in the first line of the calibration record label in the ASP-1 can. In the units column, enter (1.) 2π CPM (or CPS) or (2.) TRUE CPM (or CPS), as appropriate. Record the ASP-1 S/N on the label.

F.4. HP-190A

Unless otherwise specified, calibrate in CPM.

- a. If mR/h is to be used, preset and precalibrate as follows: (Skip to c. if CPM is to be used.)

1. Meter label: mR/h
2. Multiplier dial: X1K-X.01
3. Dead time switches: 230 μ sec (2, 4, 32, 64, and 128 closed)
4. Time switches: MIN open, HOUR closed
5. Calibration switches: 3 closed, 4 closed
6. Speaker dividers: 1 closed. All others open.
7. HV output: 900V
8. ASP-1 range switch: 1X
9. Set MP CPM: 2K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no count increase.
14. Disconnect MP.
15. Standard current: Adjust CAL pot for .62

- b. Calibration to radiation, mR/h (cap on).

1. Set range switch to X10.
2. Place the HP-190A in a 7.5 mR/h field, from the side. (Stick source, S/N 151.) Adjust the CAL pot for 7.5 on the meter.

CAUTION: The standard current must not be below 0.42

3. Set range switch to X1K.
4. Place the HP-190A on the well (S/N 125) in a 250 mR/h field. Set the dead time switches for a reading of 250.
5. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. Check the over-range point. (It is not necessary to make two integrations. Simply move the range switch for the second reading.)
6. When the readings are all within limits, including the over-range point (400 to 750 mR/h), record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
7. Fill in the first line of the calibration record label inside the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to mR/H is now completed.

c. CPM Calibration, HP-190A

When CPM calibration is called for, gamma will still be used to finalize the dead time switch settings.

Preset and precalibrate as follows for HP-190A/CPM.

- | | |
|----------------------------|------------------------------------|
| 1. Meter label: | CPM |
| 2. Multiplier dial: | X10M-X100 |
| 3. Dead time switches: | 230 (2, 4, 32, 64, and 128 closed) |
| 4. Time switches: | MIN closed, HOUR open |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 900V |
| 8. ASP-1 range switch: | X10K |
| 9. Set MP CPM: | 8K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 8.3K on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|---|--------------------------------------|
| 17. ASP-1 response: | INTEGRATE |
| 18. RESET, time for 30 sec.: | Meter reads 4.1K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 80, ASP range X100: | Read 80 CPM, ± 1 small div. |
| 21. MP 800, range X1K: | Read 800 CPM, ± 1 small div. |
| 22. MP 40K, range X100K: | Read 47K CPM, ± 1 small div. |
| 23. MP 200K, range X1M: | Read 520K CPM, ± 1 small div. |
| 24. MP 200K, range X10M: | Read 520K CPM, ± 1 small div. |
| 25. Disconnect MP. Connect the HP-190A, cap on. | |

- d. Calibrate to radiation, HP-190A/CPM.
1. Set ASP-1 to X100K. Select SLOW.
 2. Expose detector to a 25 mR/h field (low well). Note the CPM reading (41.8K to 68.2K CPM). Multiply the CPM reading by 10 to get the nominal 250 mR/h CPM.
 3. Set the range switch to X1M.
 4. Expose the HP-190A to a 250 mR/h field (middle well). Set the dead time switches for the CPM value computed in 2 above (200 to 254 μ sec. limit).
 5. Increase the field, watching the ASP-1 meter, until over-range. Clear the over-range, OFF and ON.
 6. Expose the detector (cap off) to the two sources specified on the calibration certificate. Compute the efficiencies of each. Should be from 31 to 41 percent efficient and the two values within 10 percent of each other.
 7. Record all the data called for on the calibration certificate, including the ASP-1 S/N. Sign and date the certificate.
 8. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

F.5. HP-210 (All Versions), HP-260, HP-360

Unless otherwise specified, calibrate in CPM.

- a. If mR/h is to be used, preset and precalibrate as follows: (Skip to c. if CPM is to be used.)

1. Meter label: mR/h
2. Multiplier dial: X1K-X.01
3. Dead time switches: 80 μ sec (16 and 64 closed)
4. Time switches: MIN open, HOUR closed
- *5. Calibration switches: *3 open, 4 closed
6. Speaker dividers: 1 closed. All others open.
7. HV output: 900V
8. ASP-1 range switch: 1X
9. Set MP CPM: 2K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no count increase.
14. Disconnect MP.
15. Standard current: *Adjust CAL pot for .77

*Attempt cal with CAL SW3 open, 4 closed, standard current .77.

If reading remains low at CAL pot full cw, set CAL SW 3 and 4 both closed, standard current .43.

- b. Calibration to radiation, HP-210, HP-260, mR/h.

1. Set range switch to X10.
2. Place the detector in a 7.5 mR/h field, face on. (Stick source, S/N 151.)

Note: Use 1/4" plastic (plexiglas) between source and detector, placed in contact with detector.

3. Adjust CAL pot for 7.5 on the meter. (If it won't adjust up to the reading, close CAL SW 3, also.)

CAUTION: The standard current must not be below 0.42

4. Set range switch to X1K.
5. Place the detector face down on the middle well (S/N 125), and set for a field of 750 mR/h. Set the dead time switches for a reading of 750 (55 to 100 μ sec.).
6. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. Check for over-range and note the well dial reading. On the calibration certificate, record greater than (XXXX) last field given on the well chart. (Over-range will occur above full scale on the highest range.) It is not necessary to make two

integrations. Simply move the range switch for the second reading.

7. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
8. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to mR/h is now complete.

c. CPM Calibration, HP-210, HP-260, HP-360, CPM

When CPM calibration is called for, gamma will still be used to finalize the dead time switch settings.

Preset and precalibrate as follows for HP-210, HP-260, CPM.

- | | |
|----------------------------|--------------------------------|
| 1. Meter label: | CPM |
| 2. Multiplier dial: | X10M-X100 |
| 3. Dead time switches: | 80 (16 and 64 closed) |
| 4. Time switches: | MIN closed, HOUR open |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 900V |
| 8. ASP-1 range switch: | X10K |
| 9. Set MP CPM: | 8K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 8.1K on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--|------------------------------------|
| 17. ASP-1 response: | INTEGRATE |
| 18. RESET, time for 30 sec.: | Meter reads 4K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 80, ASP range X100: | Read 80 CPM, ± 1 small div. |
| 21. MP 800, range X1K: | Read 800 CPM, ± 1 small div. |
| 22. MP 80K, range X100K: | Read 90K CPM, ± 1 small div. |
| 23. MP 400K, range X1M: | Read 830K CPM, ± 1 small div. |
| 24. MP 800K, range X10M: | Read 2.8M CPM, ± 1 small div. |
| 25. Disconnect MP. Connect the detector. | |

d. Calibration to radiation, HP-210, HP-260, HP-360, CPM

1. Set ASP-1 to X10K. Select SLOW.
2. Expose the detector to a 2 mR/h field (source S/N 120). Note the CPM reading. (5.4K to 9K CPM.) Multiply the CPM reading by 375 to get the nominal 750 mR/h CPM.

NOTE

Use 1/4" plastic (plexiglas) between source and detector, placed in contact with detector.

3. Set the range switch to X10M.
4. Expose the detector to a 750 mR/h field (middle well). Set the dead time switches for the CPM value computed in 2. above. (55 to 100 μ sec limit.)
5. Increase the field, watching the ASP-1 meter, until over-range. Record the CPM number at over-range. Clear the over-range, OFF and ON.
6. Expose the detector to the two sources specified on the calibration certificate. Compute the efficiency of each. Should be 40 percent or greater and the two efficiency numbers should be within 10 percent of each other.
7. Record all of the data called for on the calibration certificate, including the ASP-1 S/N. Sign and date the certificate.
8. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

F.6. HP270

Unless otherwise specified, calibrate in mR/h.

- a. If mR/h is to be used, preset and precalibrate as follows: (Skip to c. if $\mu\text{Sv/h}$ is to be used.)

1. Meter label: mR/h
2. Multiplier dial: X10K-X.1
3. Dead time switches: 112 μsec (16, 32 and 64 closed)
4. Time switches: MIN open, HOUR closed
5. Calibration switches: 3 open, 4 open
6. Speaker dividers: 1 closed. All others open.
7. HV output: 900V
8. ASP-1 range switch: X10
9. Set MP CPM: 8K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no count increase.
14. Disconnect MP.
15. Standard current: Adjust CAL pot for .73

- b. Calibration to radiation, HP-270, mR/h

1. Set range switch to X10.
2. Place the HP-270 in a 7.5 mR/h field, side on, shield closed. (Stick source S/N 151.)
3. Adjust CAL pot for 7.5 on the meter.
CAUTION: The standard current must not be below 0.42
4. Set range switch to X1K.
5. Place the HP-270, shield closed, on the middle well (S/N 125), and set for a field of 750 mR/h. Set the dead time switches for a reading of 750. (95 to 130 μsec .)
6. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. It is not necessary to make two integrations. Simply move the range switch for the second reading.
7. Increase the field, watching the ASP-1 meter, until over-range. Record the mR/h reading at over-range. Clear the alarm, OFF and ON.
8. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to mR/h is now complete.

c. Calibration to cpm, HP270

- | | |
|----------------------------|---------------------------------|
| 1. Meter label: | cpm |
| 2. Multiplier dial: | X10M - X100 |
| 3. Dead time switches: | 80 μ sec (16 and 64 closed) |
| 4. Time switches: | MIN closed, Hour open |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 900 V |
| 8. ASP-1 range switch: | X10K |
| 9. Set MP CPM: | 8K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRES pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1 V. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 8.1K on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42.

- | | |
|--|-----------------------------------|
| 17. ASP-1 response: | INTEGRATE |
| 18. RESET, time for 30 sec.: | Meter read 4K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 80, ASP range X100: | Read 80 CPM, ± 1 small div. |
| 21. MP 800, range X1K: | Read 800 CPM, ± 1 small div. |
| 22. MP 80K, range X100K: | Read 90K CPM, ± 1 small div. |
| 23. MP 400K, range X1M: | Read 830K CPM, ± 1 small div. |
| 24. MP 800K, range X10M: | Read 2.8M CPM, ± 1 small div. |
| 25. Disconnect MP. Connect the detector. | |

d. Calibration to radiation, HP-270, CPM

1. Set ASP-1 to X10K. Select SLOW.
2. Expose the detector shield closed to a 2 mR/h field (source S/N 120). Note the CPM reading. (1.8K to 3K CPM) Multiply the CPM reading by 375 to get the nominal 750 mR/h CPM.

NOTE

Use 1/4" plastic (plexiglas) between source and detector, placed in contact with detector.

3. Set the range switch to X10M.
4. Expose the detector to a 750 mR/h field (middle well). Set the dead time switches for the CPM

value computed in 2. above. (95 to 130 μ sec. limit.)

5. Increase the field, watching the ASP-1 meter, until over-range. Record the CPM number at over-range. Clear the over-range, OFF and ON.
6. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
7. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to cpm is now complete.

e. Calibration to $\mu\text{Gy/h}$, HP270

Preset and precalibrate as follows:

- | | |
|--------------------------|--|
| 1. Meter label: | $\mu\text{Gy/h}$ |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 112 μsec (16, 32 and 64 closed) |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 open, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 900V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 8K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Disconnect MP. | |
| 15. Standard current: | Adjust CAL pot for .73 |

f. Calibration to radiation, HP-270, $\mu\text{Gy/h}$

1. Set the range switch to X100.
2. Place the HP-270 in a 7.5 mR/h field, side on, shield closed. (Stick source S/N 151.)
3. Adjust CAL pot for 75 $\mu\text{Gy/h}$ on the meter.

CAUTION: The standard current must not be below 0.42

4. Set range switch to X10K.
5. Place the HP-270, shield closed, on the middle well (S/N 125), and set for a field of 750 mR/h. Set the dead time switches for a reading of 7.5K $\mu\text{Gy/h}$. (95 to 130 μsec .)
6. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. It is not necessary to make two integrations. Simply move the range switch for the second reading.
7. Increase the field, watching the ASP-1 meter, until over-range. Record the $\mu\text{Gy/h}$ reading at over-range. Clear the alarm, OFF and ON.
8. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded

on the label. The calibration to $\mu\text{Gy/h}$ is now complete.

mR/h

cpm

$\mu\text{Gy/h}$

F.7. HP-290

Unless otherwise specified, calibrate in R/h.

- a. If R/h is to be used, preset and precalibrate as follows:

- | | |
|--------------------------|--------------------------------|
| 1. Meter label: | R/h |
| 2. Multiplier dial: | X100-X.001 |
| 3. Dead time switches: | 20 (4 and 16 closed) |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 550V |
| 8. ASP-1 range switch: | X.1 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Disconnect MP. | |
| 15. Standard current: | Adjust CAL pot for .59 |

- b. Calibration to radiation, HP-290, R/h

1. Set range switch to X1.
2. Place the HP-290 in a 750 mR/h field, side on. (Middle well, EIC 125.)
4. Set range switch to X10K.

CAUTION: The standard current must not be below 0.42

3. Adjust CAL pot for .75 on the meter.
4. Set range switch to X100.
5. Place the HP-290 on the high well, EIC 124, and set for a field of 25 R/h. Set the dead time switches for a reading of 25. (15 to 25 μ sec.)
6. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. It is not necessary to make two integrations. Simply move the range switch for the second reading.
7. Increase the field, watching the ASP-1 meter, until over-range. Record the R/h reading at over-range. Clear the alarm, OFF and ON.

8. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to R/h is now complete.

c. Calibration to mR/h, HP-290

Preset and precalibrate as follows:

- | | |
|--------------------------|--------------------------------|
| 1. Meter label: | mR/h |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 20 μ sec (4 and 16 closed) |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 550V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Disconnect MP. | |
| 15. Standard current: | Adjust CAL pot for .59 |

d. Calibration to radiation, HP-290, mR/h.

1. Set range switch to X1K.
2. Place the HP-290 in a 750 mR/h field, side on. (Middle well, EIC 125.)
3. Adjust CAL pot for 750 on the meter.

CAUTION: The standard current must not be below 0.42

4. Set range switch to X100K.
5. Place the HP-290 on the high well, EIC 124, and set for a field of 25 R/h. Set the dead time switches for a reading of 25K mR/h. (15 to 25 μ sec.)
6. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. It is not necessary to make two integrations. Simply move the range switch for the second reading.
7. Increase the field, watching the ASP-1 meter, until over-range. Record the mR/h reading at over-

range. Clear the alarm, OFF and ON.

8. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to mR/h is now complete.

e. Calibration to $\mu\text{Gy/h}$, HP-290

Preset and Precalibrate as follows:

- | | |
|--------------------------|--------------------------------------|
| 1. Meter label: | $\mu\text{Gy/h}$ |
| 2. Multiplier dial: | X1M-X10 |
| 3. Dead time switches: | 20 μsec (4 and 16 closed) |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 550V |
| 8. ASP-1 range switch: | X1K |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Disconnect MP. | |
| 15. Standard current: | Adjust CAL pot for .59 |

f. Calibration to radiation, $\mu\text{Gy/h}$, HP-290

1. Set the range switch to X10K.
2. Place the HP-290 in a 750 mR/h field, side on. (Middle well, EIC 125.)
3. Adjust CAL pot for 7.5K $\mu\text{Gy/h}$ on the meter.

CAUTION: The standard current must not be below 0.42

4. Set the range switch to X1M.
5. Place the HP-290 on the high well (EIC 124) and set for a field of 25 R/h. Set the dead time switches for a reading of 250K $\mu\text{Gy/h}$. (15 to 25 μsec .)
6. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. It is not necessary to make two integrations. Simply move the range switch for the second reading.

7. Increase the field, watching the ASP-1 meter, until over-range. Record the $\mu\text{Gy/h}$ reading at over-range. Clear the alarm, OFF and ON.
8. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to $\mu\text{Gy/h}$ is now complete.

G. Calibration to mGy/h, HP-290

Preset and precalibrate as follows:

- | | |
|--------------------------|--------------------------------------|
| 1. Meter label: | mGy/h |
| 2. Multiplier dial: | X1K-X.01 |
| 3. Dead time switches: | 20 μsec (4 and 16 closed) |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 closed, 4 open |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 550V |
| 8. ASP-1 range switch: | X1 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Disconnect MP. | |
| 15. Standard current: | Adjust CAL pot for .59 |

h. Calibration to radiation, mGy/h, HP-290

1. Set the range switch to X10.
2. Place the HP-290 in a 750 mR/h field, side on. (Middle well, EIC 125.)
3. Adjust CAL pot for 7.5 mGy/h on the meter.

CAUTION: The standard current must not be below 0.42

4. Set the range switch to X1K.
5. Place the HP-290 on the high well (EIC 124) and set for a field of 25 R/h. Set the dead time switches for a reading of 250 mGy/h. (15 to 25 μsec .)
6. Run the linearity tests shown on the calibration certificate. If necessary, the dead time value may be changed to adjust the higher field readings. It is not necessary to make two integrations. Simply

move the range switch for the second reading.

7. Increase the field, watching the ASP-1 meter, until over-range. Record the mGy/h reading at over-range. Clear the alarm, OFF and ON.
8. When the readings are all within limits, record all the data indicated on the certificate, including the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to mGy/h is now complete.

F.8. LEG-1

Unless otherwise specified, calibrate in CPM.

a. If CPM is to be used, preset and precalibrate as follows: (Skip to b. if CPS is to be used.)

1. Meter label: CPM
2. Multiplier dial: X10M-X100
3. Dead time switches: 8 μ sec. (8 closed)
4. Time switches: MIN closed, HOUR open.
5. Calibration switches: 3 closed, 4 open.
6. Speaker dividers: 1 closed. All others open.
7. HV output: Not over 1000V.
8. ASP-1 range switch: X10K
9. Set MP CPM: 8K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 200 mV. Observe no count increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 8K on meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET, time for 30 sec: Meter reads $4K \pm 1$ small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 80, ASP-1 range X100: Read 80 CPM, ± 1 small div.
21. MP 800, range X1K: Read 800 CPM, ± 1 small div.
22. MP 80K, range X100K: Read 81K CPM, ± 1 small div.
23. MP 800K, range X1M: Read 900K cpm, ± 1 small div.
24. MP 1.6M, range X10M: Read 2M CPM, ± 1 small div.
25. Close 32 dead time switch: Over-range
26. Open 32 dead time switch:
27. ASP-1: OFF
28. Disconnect MP.

Skip b. Proceed to c.

b. LEG-1, CPS

Preset and precalibrate as follows:

- | | |
|----------------------------|------------------------------------|
| 1. Meter label: | CPS |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 8 μ sec. (8 closed) |
| 4. Time switches: | MIN open, HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 67 on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--------------------------------|---|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Read 2K on range X10K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 40, ASP-1 range X1: | Read .67 CPS, ± 1 small div. |
| 21. MP 400, range X10: | Read 6.7 CPS, ± 1 small div. |
| 22. MP 40K, range X1K: | Read 670 CPS, ± 1 small div. |
| 23. MP 400K, range X10K: | Read 7K CPS, ± 1 small div. |
| 24. MP 1.6M, range X100K: | Read 34K CPS, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

c. LEG-1, calibration to source

1. Connect the LEG-1 to the ASP-1.
2. Place the ^{241}Am source called for on the calibration certificate against the face of the LEG-1.
3. Bring up the HV while observing the count rate on the ASP-1. Locate the appropriate ends of the voltage plateau and observe the HV at each end. Select an operating HV at about 1/3 of the way up from the knee. Record the plateau count rate on the calibration certificate.
4. Compute the efficiency for the LEG-1 according to the formulas on the calibration certificate. The value should be 45 to 55 percent. Record it on the certificate.
5. Expose the LEG-1 to ^{137}Cs and determine the ASP-1 reading at over-range. Record the reading on the certificate.
6. Fill in the data indicated on the calibration certificate, including the ASP-1 S/N. Sign and date the certificate.
7. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

F.9. NRD

Unless otherwise specified, calibrate in mrem/h

a. NRD, mrem/h

Preset and precalibrate as follows:

- | | |
|--------------------------|-----------------------------------|
| 1. Meter label: | mrem/h |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 10 μ sec (2 and 8 closed) |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 open, 4 closed |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 1500V or less |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 2 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV observe no count increase. |
| 14. Set MP amplitude: | SLOW |
| 16. ASP-1 CAL pot: | Set for 88 mrem/h on meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|---------------------------------|--|
| 17. ASP-1 range switch: | X1 |
| 18. ASP-1 response: | INTEGRATE. |
| 19. RESET, time for 30 seconds: | Meter reads $.73 \pm 1$ small div. |
| 20. Response: | SLOW or FAST, as preferred. |
| 21. MP CPM 40, ASP-1 range X1: | Read $.88$ mrem/h, ± 1 small div. |
| 22. MP 400, range X10: | Read 8.8 mrem/h, ± 1 small div. |
| 23. MP 40K, range X1K: | Read 890 mrem/h ± 1 small div. |
| 24. MP 400K, range X10K: | Read $9.5K$ mrem/h, ± 1 small div. |
| 25. MP 1.6M, range X100K: | Read $50K$ mrem/h, ± 1 small div. |
| 26. Close DT switch 32: | Over-range |
| 27. Open DT switch 32. | |
| 28. ASP-1: | OFF |
| 29. Disconnect MP. | |

b. Calibration to neutrons, mrem/h

1. Connect the NRD to the ASP-1.
2. Set the range switch to X1.

3. Put the NRD in a 10 R/h ^{137}Cs field and adjust the HV for approximately 1 mrem reading on X10 range. Decrease by 50 V verify no counts in 10R field.
4. Set the NRD on the neutron well and set the well for 27 mrem/h.
5. Adjust the CAL pot for a reading of 27 on the X100 range. Record the reading on the certificate.
6. Set the well for 200 mrem/h and take the reading on X1K. Record it on the certificate.

CAUTION: The standard current must not be below 0.42.

7. Record all the data indicated on the calibration certificate, including the ASP-1 S/N. Sign and date it.
8. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to mrem/h is now complete.

c. NRD, $\mu\text{Sv/h}$

Preset and precalibrate as follows:

1. Meter label: $\mu\text{Sv/h}$
2. Multiplier dial: X1M-X10
3. Dead time switches: 10 μsec (2 and 8 closed)
4. Time switches: MIN open, HOUR closed
5. Calibration switches: 3 open, 4 closed
6. Speaker dividers: 1 closed. All others open.
7. HV output: 1500V or less
8. ASP-1 range switch: X1K
9. Set MP CPM: 4K CPM
10. Set MP amplitude: 2 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 200 mV observe no count increase.
14. Set MP amplitude: 3 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 880 $\mu\text{Sv/h}$ on meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 range switch X10:
18. ASP-1 response: INTEGRATE.
19. RESET time for 30 sec: Meter reads 7.3 ± 1 small div.
20. Response: SLOW or FAST, as preferred.
21. MP CPM 40, ASP-1 range X10: Read 8.8 $\mu\text{Sv/h}$, ± 1 small div.
22. MP 400, range X100: Read 88 $\mu\text{Sv/h}$, ± 1 small div.
23. MP 40K, range X10K: Read 8.9K $\mu\text{Sv/h}$, ± 1 small div.
24. MP 400K, range X100K: Read 95K $\mu\text{Sv/h}$, ± 1 small div.
25. MP 1.6M, range X1M: Read 500K $\mu\text{Sv/h}$, ± 1 small div.
26. Close DT switch 32: Over-range
27. Open DT switch 32.
28. ASP-1: OFF
29. Disconnect MP.

d. Calibration to neutrons, $\mu\text{Sv/h}$

1. Connect the NRD to the ASP-1.
2. Set the range switch to X10.
3. Put the NRD in a 10 R/h ^{137}Cs field and adjust the HV for approximately a full scale reading on X10 range.

4. Set the NRD on the neutron well and set the well for 27 mrem/h.
5. Adjust the CAL pot for a reading of 270 on the X1K range. Record the reading on the certificate.

CAUTION: The standard current must not be below 0.42

6. Set the well for 200 mrem/h and take the reading on X10K. Record it on the certificate.
7. Record all the data indicated on the calibration certificate, including the ASP-1 S/N. Sign and date it.
8. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to $\mu\text{Sv/h}$ is now complete.

e. NRD, rem/h

Preset and precalibrate as follows:

- | | |
|----------------------------|-----------------------------------|
| 1. Meter label: | rem/h |
| 2. Multiplier dial: | X100-X.001 |
| 3. Dead time switches: | 10 μ sec (2 and 8 closed) |
| 4. Time switches: | MIN open, HOUR closed |
| 5. Calibration switches: | 3 open, 4 closed |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | 1500V or less |
| 8. ASP-1 range switch: | X.1 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 2 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV observe no count increase. |
| 14. Set MP amplitude: | 3 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for .088 rem/h on meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|-----------------------------------|---------------------------------------|
| 17. ASP-1 range switch: | X.001 |
| 18. ASP-1 response: | INTEGRATE. |
| 19. RESET time for 30 sec: | Meter reads .00073 $\pm$ 1 small div. |
| 20. Response: | SLOW or FAST, as preferred. |
| 21. MP CPM 40, ASP-1 range X.001: | Read .00088 rem/h, $\pm$ 1 small div. |
| 22. MP 400, range X.01: | Read .0088 rem/h, $\pm$ 1 small div. |
| 23. MP 40K, range X1: | Read .89 rem/h, $\pm$ 1 small div. |
| 24. MP 400K, range X10: | Read 9.5 rem/h, $\pm$ 1 small div. |
| 25. MP 1.6M, range X100: | Read 50 rem/h, $\pm$ 1 small div. |
| 26. Close DT switch 32: | Over-range |
| 27. Open DT switch 32. | |
| 28. ASP-1: | OFF |
| 29. Disconnect MP. | |

f. Calibration to neutrons, rem/h

1. Connect the NRD to the ASP-1.
2. Set the range switch to X.001.
3. Put the NRD in a 10 R/h ^{137}Cs field and adjust the HV for approximately a full scale reading on X.001 range.

4. Set the NRD on the neutron well and set the well for 27 mrem/h.
5. Adjust the CAL pot for a reading of .027 on the X.1 range. Record the reading on the certificate.

CAUTION: The standard current must not be below 0.42

6. Set the well for 200 mrem/h and take the reading on X1. Record it on the certificate.
7. Record all the data indicated on the calibration certificate, including the ASP-1 S/N. Sign and date it.
8. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to rem/h is now complete.

g. NRD, $\mu\text{Sv/min}$

Preset and precalibrate as follows:

1. Meter label: $\mu\text{Sv/min}$
2. Multiplier dial: X10K-X.1
3. Dead time switches: 10 μsec (2 and 8 closed)
4. Time switches: MIN closed, HOUR open
5. Calibration switches: 3 closed, 4 closed
6. Speaker dividers: 1 closed. All others open.
7. HV output: 1500V or less
8. ASP-1 range switch: X10
9. Set MP CPM: 2K CPM
10. Set MP amplitude: 2 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 200 mV observe no count increase
14. Set MP amplitude: 3 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 7.4 $\mu\text{Sv/min}$ on meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET time for 30 sec: Meter reads 3.7 ± 1 small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 20, ASP-1 range X.1: Read .074 $\mu\text{Sv/min}$, ± 1 small div.
21. MP 200, range X1: Read .74 $\mu\text{Sv/min}$, ± 1 small div.
22. MP 20K, range X100: Read 74 $\mu\text{Sv/min}$, ± 1 small div.
23. MP 200K, range X1K: Read 770 $\mu\text{Sv/min}$, ± 1 small div.
24. MP 1.6M, range X10K: Read 8.4K $\mu\text{Sv/min}$, ± 1 small div.
25. Close DT switch 32: Over-range
26. Open DT switch 32.
27. ASP-1: OFF
28. Disconnect MP.

h. Calibration to neutrons, $\mu\text{Sv/min}$

1. Connect the NRD to the ASP-1.
2. Set the range switch to X1.
3. Put the NRD in a 10 R/h ^{137}Cs field and adjust the HV for a reading between .15 and .25 on the X1 range.

4. Set the NRD on the neutron well and set the well for 27 mrem/h.
5. Adjust the CAL pot for a reading of 4.5 on the X10 range. Record the reading on the certificate.

CAUTION: The standard current must not be below 0.42

6. Set the well for 200 mrem/h and take the reading on X100. Record it on the certificate.
7. Record all the data indicated on the calibration certificate, including the ASP-1 S/N. Sign and date it.
8. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label. The calibration to $\mu\text{Sv}/\text{min}$ is now complete.

mrem/h

$\mu\text{Sv/h}$

rem/h

$\mu\text{Sv/min}$

F.10. SPA-2, 1 X 1

Unless otherwise specified, calibrate in CPM.

a. SPA-2, 1 X 1, CPM

Preset and precalibrate as follows:

1. Meter label: CPM
2. Multiplier dial: X10M-X100
3. Dead time switches: 12 μ sec. (4 and 8 closed)
4. Time switches: MIN closed, HOUR open.
5. Calibration switches: 3 closed, 4 open.
6. Speaker dividers: 16 closed. All others open.
7. HV output: Not over 1000V.
8. ASP-1 range switch: X10K
9. Set MP CPM: 8K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no counts increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 8K on ASP-1 meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET, time for 30 sec: Meter reads $4K \pm 1$ small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 80, ASP-1 range X100: Read 80 CPM, ± 1 small div.
21. MP 800, range X1K: Read 800 CPM, ± 1 small div.
22. MP 80K, range X100K: Read 81K CPM, ± 1 small div.
23. MP 800K, range X1M: Read 950K cpm, ± 1 small div.
24. MP 1.6M, range X10M: Read 2.4M CPM, ± 1 small div.
25. Close 32 dead time switch: Over-range
26. Open 32 dead time switch:
27. ASP-1: OFF
28. Disconnect MP

Skip b. Proceed to c.

b. SPA-2, 1 X 1, CPS

Preset and precalibrate as follows:

1. Meter label: CPS
2. Multiplier dial: X100K-X1
3. Dead time switches: 12 μ sec. (4 and 8 closed)
4. Time switches: MIN open, HOUR open.
5. Calibration switches: 3 open, 4 closed.
6. Speaker dividers: 16 closed. All others open.
7. HV output: Not over 1000V
8. ASP-1 range switch: X100
9. Set MP CPM: 4K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no count increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 67 on ASP-1 meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET, time for 30 sec: Read 2K on range X10K, ± 1 small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 40, ASP-1 range X1: Read .67 CPS, ± 1 small div.
21. MP 400, range X10: Read 6.7 CPS, ± 1 small div.
22. MP 40K, range X1K: Read 670 CPS, ± 1 small div.
23. MP 400K, range X10K: Read 7.2K CPS, ± 1 small div.
24. MP 1.6M, range X100K: Read 39K CPS, ± 1 small div.
25. Close 32 dead time switch: Over-range
26. Open 32 dead time switch:
27. ASP-1: OFF
28. Disconnect MP.

c. SPA-2, 1 X 1, calibration to source

1. Connect the detector to the ASP-1.
2. Place a CS-7A source about a foot from the crystal.
3. Vary the HV while observing the count rate. Locate the approximate ends of the voltage plateau and observe the HV at each end. Select an operating HV at about 1/4 of the way up from the knee. Set the HV accordingly and record the HV on the calibration certificate.
4. Remove the check source and note the background reading.
5. Place the detector in a 1 mR/h ^{137}Cs field (EI-153). Subtract the background count rate and multiply the result by 10.
6. Place the detector in a 10 mR/h field (EI-151) and set the dead time switches for the count rate found in 5. above. Dead time limits 8 to 16 μsec .
7. Observe the ASP-1 meter while increasing the field. Record the reading at over-range on the calibration certificate. Clear the over-range.
8. Fill in the spaces indicated on the calibration certificate, including the range switch settings and the readings at 1 and 10 mR/h. The rate units blank is CPM or CPS. Fill in the detector model number, if applicable, and fill in the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

F.11. SPA-3

Unless otherwise specified, calibrate in CPM.

a. SPA-3, CPM

Preset and precalibrate as follows:

1. Meter label: CPM
2. Multiplier dial: X10M-X100
3. Dead time switches: 14 μ sec. (2, 4 and 8 closed)
4. Time switches: MIN closed, HOUR open.
5. Calibration switches: 3 closed, 4 open.
6. Speaker dividers: 64 closed. All others open.
7. HV output: Not over 1000V.
8. ASP-1 range switch: X10K
9. Set MP CPM: 8K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no counts increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 8K on ASP-1 meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET, time for 30 sec: Meter reads $4K \pm 1$ small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 80, ASP-1 range X100: Read 80 CPM, ± 1 small div.
21. MP 800, range X1K: Read 800 CPM, ± 1 small div.
22. MP 80K, range X100K: Read 82K CPM, ± 1 small div.
23. MP 800K, range X1M: Read 980K cpm, ± 1 small div.
24. MP 1.6M, range X10M: Read 2.6M CPM, ± 1 small div.
25. Close 32 dead time switch: Over-range
26. Open 32 dead time switch:
27. ASP-1: OFF
28. Disconnect MP.

Skip b. Proceed to c.

b. SPA-3, CPS

Preset and precalibrate as follows:

- | | |
|----------------------------|-----------------------------------|
| 1. Meter label: | CPS |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 14 μ sec. (2, 4 and 8 closed) |
| 4. Time switches: | MIN open, HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 64 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 67 on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--------------------------------|---|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Read 2K on range X10K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 40, ASP-1 range X1: | Read .67 CPS, ± 1 small div. |
| 21. MP 400, range X10: | Read 6.7 CPS, ± 1 small div. |
| 22. MP 40K, range X1K: | Read 670 CPS, ± 1 small div. |
| 23. MP 400K, range X10K: | Read 7.4K CPS, ± 1 small div. |
| 24. MP 1.6M, range X100K: | Read 43K CPS, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | |
| 27. ASP-1: | OFF |
| 28. Disconnect MP. | |

c. SPA-3, calibration to source

1. Connect the SPA-3 to the ASP-1.
2. Place a CS-7A source about a foot from the crystal.
3. Vary the HV while observing the count rate. Locate the approximate ends of the voltage plateau and observe the HV at each end. Select an operating HV at about 1/4 of the way up from the knee. Set the HV accordingly and record the HV on the calibration certificate.
4. Remove the check source and note the background reading.
5. Place the detector in a 1/2 mR/h ^{137}Cs field (EI-120). Subtract the background count rate and multiply the result by 4.
6. Place the detector in a 2 mR/h field (EI-120) and set the dead time switches for the count rate found in 5. above. Dead time limits 10 to 18 μsec .
7. Observe the ASP-1 meter while increasing the field. Record the reading at over-range on the calibration certificate. Clear the over-range.
8. Fill in the spaces indicated on the calibration certificate, including the range switch settings and the readings at 1/2 and 2 mR/h. The rate units blank is CPM or CPS. Fill in the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

F.12. SPA-6

Unless otherwise specified, calibrate in CPM.

a. SPA-6, CPM

Preset and precalibrate as follows:

1. Meter label: CPM
2. Multiplier dial: X10M-X100
3. Dead time switches: 12 μ sec. (4 and 8 closed)
4. Time switches: MIN closed, HOUR open.
5. Calibration switches: 3 closed, 4 open.
6. Speaker dividers: 16 closed. All others open.
7. HV output: Not over 1000V.
8. ASP-1 range switch: X10K
9. Set MP CPM: 8K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no counts increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 8K on ASP-1 meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET, time for 30 sec: Meter reads $4K \pm 1$ small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 80, ASP-1 range X100: Read 80 CPM, ± 1 small div.
21. MP 800, range X1K: Read 800 CPM, ± 1 small div.
22. MP 80K, range X100K: Read 81K CPM, ± 1 small div.
23. MP 800K, range X1M: Read 950K cpm, ± 1 small div.
24. MP 1.6M, range X10M: Read 2.4M CPM, ± 1 small div.
25. Close 32 dead time switch: Over-range
26. Open 32 dead time switch:
27. ASP-1: OFF
28. Disconnect MP

Skip b. Proceed to c.

b. SPA-6, CPS

Preset and precalibrate as follows:

1. Meter label: CPS
2. Multiplier dial: X100K-X1
3. Dead time switches: 12 μ sec. (4 and 8 closed)
4. Time switches: MIN open, HOUR open.
5. Calibration switches: 3 open, 4 closed.
6. Speaker dividers: 16 closed. All others open.
7. HV output: Not over 1000V
8. ASP-1 range switch: X100
9. Set MP CPM: 4K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no count increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 67 on ASP-1 meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET, time for 30 sec: Read 2K on range X10K, ± 1 small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 40, ASP-1 range X1: Read .67 CPS, ± 1 small div.
21. MP 400, range X10: Read 6.7 CPS, ± 1 small div.
22. MP 40K, range X1K: Read 670 CPS, ± 1 small div.
23. MP 400K, range X10K: Read 7.2K CPS, ± 1 small div.
24. MP 1.6M, range X100K: Read 39K CPS, ± 1 small div.
25. Close 32 dead time switch: Over-range
26. Open 32 dead time switch:
27. ASP-1: OFF
28. Disconnect MP

c. SPA-6, calibration to source

1. Connect the SPA-6 to the ASP-1.
2. Place a CS-7A source about a foot from the crystal.
3. Vary the HV while observing the count rate. Locate the approximate ends of the voltage plateau and observe the HV at each end. Select an operating HV at about 1/4 of the way up from the knee. Set the HV accordingly and record the HV on the calibration certificate.
4. Remove the check source and note the background reading.
5. Place the detector in a 1/2 mR/h ^{137}Cs field (EI-153). Subtract the background count rate and multiply the result by 10.
6. Place the detector in a 5 mR/h field (EI-153) and set the dead time switches for the count rate found in 5. above. Dead time limits 8 to 16 μsec .
7. Observe the ASP-1 meter while increasing the field. Record the reading at over-range on the calibration certificate. Clear the over-range.
8. Fill in the spaces indicated on the calibration certificate, including the range switch settings and the readings at 1/2 and 5 mR/h. The rate units blank is CPM or CPS. Fill in the ASP-1 S/N. Sign and date the certificate.
9. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

F.13. PG-2

a. Preset and precalibrate as follows:

1. Meter label: CPM
2. Multiplier dial: X10M-X100
3. Dead time switches: 12 μ sec. (4 and 8 closed)
4. Time switches: MIN closed, HOUR open.
5. Calibration switches: 3 closed, 4 open.
6. Speaker dividers: 256 closed. this is S6 switch 8.
All others open.
7. HV output: Not over 1000 Vdc.
8. ASP-1 range switch: X10K
9. Set MP CPM: 8K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no counts increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 8K on meter.

CAUTION: The standard current must not be below 0.42

17. ASP-1 response: INTEGRATE.
18. RESET, time for 30 sec: Meter reads $4K \pm 1$ small div.
19. Response: SLOW or FAST, as preferred.
20. MP CPM 80, ASP-1 range X100: Read 80 CPM, ± 1 small div.
21. MP 800, range X1K: Read 800 CPM, ± 1 small div.
22. MP 80K, range X100K: Read 81K CPM, ± 1 small div.
23. MP 800K, range X1M: Read 950K cpm, ± 1 small div.
24. MP 1.6M, range X10M: Read 2.4M CPM, ± 1 small div.
25. Close 32 dead time switch: Over-range
26. Open 32 dead time switch:
27. ASP-1: OFF
28. Disconnect MP

b. PG-2 calibration to source.

1. Connect the PG-2 to the ASP-1
2. Place ^{239}Pu source of either 2.7, 1.5 or 1.2×10^6 CPM against the face of the PG-2.

3. Bring up the HV while observing the count rate on the ASP-1. Locate the approximate ends of the voltage plateau and observe the HV at each end. Select an operating HV at about 1/3 of the way up from the knee. Record the plateau count rate on the calibration certificate.
4. The count rate at the operating voltage shall be as follows:

Approximately 2.7×10^6 cpm source, plateau must exceed 2 percent of alpha count rate of source.

Approximately 1.5×10^6 or 1.2×10^6 cpm source, plateau must exceed 1.5 percent of alpha count rate of source.
5. Fill in the data indicated on the calibration certificate, including the ASP-1 S/N. Sign and date the certificate.
6. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

F.14. SPA-8

Unless otherwise specified, calibrate in CPM.

a. SPA-8, CPM

Preset and precalibrate as follows:

- | | |
|----------------------------|---------------------------------|
| 1. Meter label: | CPM |
| 2. Multiplier dial: | X10M-X100 |
| 3. Dead time switches: | 36 μ sec. (4 and 32 closed) |
| 4. Time switches: | MIN closed, HOUR open. |
| 5. Calibration switches: | 3 closed, 4 open. |
| 6. Speaker dividers: | 16 closed. All others open. |
| 7. HV output: | Not over 1000V. |
| 8. ASP-1 range switch: | X10K |
| 9. Set MP CPM: | 8K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no counts increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 8K on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|----------------------------------|-----------------------------------|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Meter reads 4K $\pm$ 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 80, ASP-1 range X100: | Read 80 CPM, $\pm$ 1 small div. |
| 21. MP 800, range X1K: | Read 800 CPM, $\pm$ 1 small div. |
| 22. MP 80K, range X100K: | Read 84K CPM, $\pm$ 1 small div. |
| 23. MP 400K, range X1M: | Read 460K cpm, $\pm$ 1 small |
| 24. MP 800K, range X10M: | Read 1.4M CPM, $\pm$ 1 small div. |
| 25. MP 1.6M, range X10M: | Over-range |
| 26. ASP-1: | OFF |
| 27. Disconnect MP | |

Skip b & c. Proceed to d.

b. SPA-8, CPS

Preset and precalibrate as follows:

- | | |
|----------------------------|---------------------------------|
| 1. Meter label: | CPS |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 36 μ sec. (4 and 32 closed) |
| 4. Time switches: | MIN open, HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 16 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 67 on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--------------------------------|---|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Read 2K on range X10K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 40, ASP-1 range X1: | Read 0.67 CPS, ± 1 small div. |
| 21. MP 400, range X10: | Read 6.7 CPS, ± 1 small div. |
| 22. MP 40K, range X1K: | Read 690 CPS, ± 1 small div. |
| 23. MP 400K, range X10K: | Read 9.0K CPS, ± 1 small div. |
| 24. MP 800K, range X100K: | Read 26K CPS, ± 1 small div. |
| 25. MP 1.6M Range X100K: | Over-range |
| 26. ASP-1: | OFF |
| 27. Disconnect MP. | |

Skip c. Proceed to d.

c. SPA-8, $\mu\text{R/h}$

Preset and precalibrate as follows:

- | | |
|----------------------------|---------------------------------------|
| 1. Meter label: | $\mu\text{R/h}$ |
| 2. Multiplier dial: | X10K-X.1 |
| 3. Dead time switches: | 12 μsec . (4 and 8 closed) |
| 4. Time switches: | MIN open, HOUR closed. |
| 5. Calibration switches: | 3 closed, 4 closed. |
| 6. Speaker dividers: | 16 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 8K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 32 on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

Skip c. Proceed to d.

d. SPA-8, calibration to source

1. Connect the detector to the ASP-1.
2. Place a CS-7A source about a foot from the crystal.
3. Vary the HV while observing the count rate. Locate the approximate ends of the voltage plateau and observe the HV at each end. Select an operating HV at about 1/4 of the way up from the knee. Set the HV accordingly and record the HV on the calibration certificate.

If calibration is in cpm or cps, do steps 4. - 8., if in $\mu\text{R/h}$ skip to step 9.

4. Remove the check source and note the background reading.
5. Place the detector in a 1 mR/h ^{137}Cs field (EI-153). Subtract the background count rate and multiply the result by 10.
6. Place the detector in a 10 mR/h field (EI-151) and set the dead time switches for the count rate found in 5. above. Dead time limits 20 to 45 μsec .
7. Observe the ASP-1 meter while increasing the field. Record the reading at over-range on the calibration certificate. Clear the over-range.
8. Fill in the spaces indicated on the calibration certificate, including the range switch settings and the readings at 1 and 10 mR/h. The rate units blank is CPM or CPS. Fill in the detector model number, if applicable, and fill in the ASP-1 S/N. Sign and date the certificate. Skip to step 13.
9. Place the detector in a .1 mR/h field. Adjust the CAL pot for a reading of .12 mR/h.
10. Place the detector in a 7.5 mR/h field. Set the dead time switches for a reading of 7.5 mR/h. Dead Time limits 20 to 45 μsec .
11. Check linearity at .25 mR/h and 5 mR/h reading must be $\pm 20\%$ of field.
12. Fill in spaces indicated on calibration certificate, including range switch settings and readings at .10 mR/h, 7.5 mR/h, .25 mR/h and 5 mR/h. The rate units blank is $\mu\text{R/h}$. Fill in detector model number, SPA-8, ASP-1 S/N. Sign and date the certificate.
13. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is recorded on the label.

SPA-8, $\mu\text{Sv/h}$

Preset and precalibrate as follows:

1. Meter label: $\mu\text{Sv/h}$
2. Multiplier dial: X100-X.001
3. Dead time switches: 12 μsec . (4 and 8 closed)
4. Time switches: MIN open, HOUR closed.
5. Calibration switches: 3 closed, 4 closed.
6. Speaker dividers: 16 closed. All others open.
7. HV output: Not over 1000V
8. ASP-1 range switch: X1
9. Set MP CPM: 8K CPM
10. Set MP amplitude: 10 mV
11. Set GAIN pot: Full cw
12. Set THRESH pot: Set at crossover point.
13. Set MP amplitude: 1V. Observe no count increase.
14. Set MP amplitude: 15 mV
15. ASP-1 response switch: SLOW
16. ASP-1 CAL pot: Set for 52 on ASP-1 meter.

CAUTION: The standard current must not be below 0.42

SPA-8, calibration to source

1. Connect the detector to the ASP-1.
2. Place a CS-7A source about a foot from the crystal.
3. Vary the HV while observing the count rate. Locate the approximate ends of the voltage plateau and observe the HV at each end. Select an operating HV at about 1/4 of the way up from the knee. Set the HV accordingly and record the HV on the calibration certificate.
9. Place the detector in a 1 $\mu\text{Sv/h}$ (0.1 mR/h) field. Adjust the CAL pot for a reading of 1.2 $\mu\text{Sv/h}$.
10. Place the detector in a 75 $\mu\text{Sv/h}$ (7.5 mR/h) field. Set the dead time switches for a reading of 75 $\mu\text{Sv/h}$. Dead Time limits 20 to 45 μsec .
11. Check linearity at 2.5 $\mu\text{Sv/h}$ (0.25 mR/h) and 50 $\mu\text{Sv/h}$ (5 mR/h). Reading must be within $\pm 20\%$ of field.
12. Fill in spaces indicated on calibration certificate, including range switch settings and readings at 1.0 $\mu\text{Sv/h}$, 75 $\mu\text{Sv/h}$, 2.5 $\mu\text{Sv/h}$ and 50 $\mu\text{Sv/h}$. The rate units blank is $\mu\text{Sv/h}$. Fill in detector model number, SPA-8, ASP-1 S/N. Sign and date the certificate.
13. Fill in the first line of the calibration record label in the can. Make sure the ASP-1 S/N is

recorded on the label.

F.15. HP-100A

Unless otherwise specified, calibrate in CPM.

a. HP-100A, CPM

Preset and precalibrate as follows:

- | | |
|----------------------------|---------------------------------|
| 1. Meter label: | CPM |
| 2. Multiplier dial: | X10M-X100 |
| 3. Dead time switches: | 10 μ sec. (2 and 8 closed) |
| 4. Time switches: | MIN closed, HOUR open. |
| 5. Calibration switches: | 3 closed, 4 open. |
| 6. Speaker dividers: | 16 closed. All others open. |
| 7. HV output: | Not over 1000V. |
| 8. ASP-1 range switch: | X10K |
| 9. Set MP CPM: | 8K CPM |
| 10. Set MP amplitude: | 2 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no counts increase. |
| 14. Set MP amplitude: | 3 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 8K on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|----------------------------------|-----------------------------------|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Meter reads 4K $\pm$ 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 80, ASP-1 range X100: | Read 80 CPM, $\pm$ 1 small div. |
| 21. MP 800, range X1K: | Read 800 CPM, $\pm$ 1 small div. |
| 22. MP 80K, range X100K: | Read 81K CPM, $\pm$ 1 small div. |
| 23. MP 800K, range X1M: | Read 940K cpm, $\pm$ 1 small div. |
| 24. MP 1.6M, range X10M: | Read 2.3M CPM, $\pm$ 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

Skip b. Proceed to c. or d.

b. HP-100A, CPS

Preset and precalibrate as follows:

- | | |
|----------------------------|--------------------------------|
| 1. Meter label: | CPS |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 10 μ sec. (2 and 8 closed) |
| 4. Time switches: | MIN open, HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 16 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 2 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 1V. Observe no count increase. |
| 14. Set MP amplitude: | 3 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 67 on ASP-1 meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--------------------------------|---|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Read 2K on range X10K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 40, ASP-1 range X1: | Read .67 CPS, ± 1 small div. |
| 21. MP 400, range X10: | Read 6.7 CPS, ± 1 small div. |
| 22. MP 40K, range X1K: | Read 670 CPS, ± 1 small div. |
| 23. MP 400K, range X10K: | Read 7.2K CPS, ± 1 small div. |
| 24. MP 1.6M, range X100K: | Read 37K CPS, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

Proceed to c. or d.

c. Calibration to Beta Sources.

1. Flush probe with P10 gas for one hour (minimum) with a flow rate of 50 cc/min.
2. During actual plateau and counting operations, flow must be maintained at 40 cc/min or more.
3. *Plateau the probe using the isotope specified on the order. If none is specified, use ^{99}Tc .
4. Note the start of the plateau (voltage and count rate) and the upswing of the plateau (voltage and count rate just before upswing).
5. Calculate the length and slope of the plateau as follows:
 - a. High voltage at upswing minus high voltage at start of plateau equals length of plateau.
 - b. Note and read the count rate midway between the two voltages in step a.
 - c. Count rate just before upswing minus count rate at start of plateau equals change in count rate.
 - d. Calculate slope as follows:

$$\frac{\text{change in count rate (step c)}}{\text{count rate at midway point (step b)}} = \frac{\text{change in voltage (step a)}}{100}$$

= Percentage slope per 100 volts

Example: The readings on a certain detector are: 31,900 cpm at 1470 V and 40,000 cpm at 1700 V. The midway voltage is 1585 V and the count rate at that point is 38,900 cpm. Therefore:

$$\frac{8,100 \text{ cpm}}{38,900 \text{ cpm}} = \frac{230 \text{ V}}{100} = 0.2082 \quad 2.30 = 0.0905 = 9.05 \text{ percent}$$

6. Set the HV to middle of the plateau (1585 V in example). This voltage must be in the range from 1400 V to 1700 V.
7. Check background. It must be less than 5000 cpm.
8. Check efficiency, using a $100 \text{ cm}^2 \text{ }^{137}\text{Cs}$ source. Be sure to take background into account. Must be greater than 26 percent efficient, 4π .
9. Fill in the first line of the calibration record label in the ASP-1 can.

* 100 cm^2 source preferred, but any size source may be used for plateau. A $100 \text{ cm}^2 \text{ }^{137}\text{Cs}$ source is the ONLY kind that may be used to measure efficiency.

d. Calibration to Alpha sources.

1. Flush probe with P210 gas for one hour (minimum) with a flow rate of 50 cc/min.
2. During actual plateau and counting operations, flow must be maintained at 40 cc/min or more.
3. Plateau the probe using the isotope specified on the order. If none is specified, use ^{241}Am .
4. Note the start of the plateau (voltage and count rate) and the upswing of the plateau (voltage and count rate just before upswing).
5. Calculate the length and slope of the plateau as follows:
 - a. High voltage at upswing minus high voltage at start of plateau equals length of plateau.
 - b. Note and read the count rate between the two voltages in step a.
 - c. Count rate just before upswing minus count rate at start of plateau equals change in count rate.
 - d. Calculate slope as follows:
$$\frac{\text{change in count rate (step c)}}{\text{count rate at midway point (step b)}} \times \frac{\text{change in voltage (step a)}}{100}$$

= Percentage slope per 100 volts

Example: The readings on a certain detector are: 31,900 cpm at 1470 V and 40,000 cpm at 1700 V. The midway voltage is 1585 V and the count rate at that point is 38,900 cpm. Therefore:

$$40,000 \text{ cpm} - 31,900 \text{ cpm} = 8,100 \text{ cpm and } 1700 \text{ V} - 1470 \text{ V} = 230 \text{ V}$$
$$\frac{8,100 \text{ cpm}}{38,900 \text{ cpm}} \times \frac{230 \text{ V}}{100} = 0.2082 \times 230 = 0.0905 = 9.05 \text{ percent}$$

The plateau must be at least 150 V long, with a slope of less than 10 percent per 100 volts. Detector above passes.
6. Set the HV to middle of the plateau (1585 V in example). This voltage must be in the range from 1400 V to 1700 V.
7. Check background. It must be less than 200 cpm.

8. Check efficiency, using a $100\text{ cm}^{2241}\text{Am}$ source. Be sure to take background into account. Must be greater than 26% efficient, 4π
9. Fill in the first line of the calibration record label in the ASP-1 can.

F.16. SPA-1A

Unless otherwise specified, calibrate in CPM to indicate the 2π value of the source.

a. If CPM is to be used, preset and precalibrate as follows: (Skip to b. if CPS is used.)

- | | |
|----------------------------|-------------------------------------|
| 1. Meter label: | CPM |
| 2. Multiplier dial: | X10M-X100 |
| 3. Dead time switches: | 10 (2 and 8) |
| 4. Time switches: | MIN closed, HOUR open. |
| 5. Calibration switches: | 3 closed, 4 open. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | Not over 1000V. |
| 8. ASP-1 range switch: | X10K |
| 9. Set MP CPM: | 8K |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV. Observe no counts increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 8K on meter. |

CAUTION: The standard current must not be below 0.42.

- | | |
|----------------------------------|-----------------------------------|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Meter reads $4K \pm 1$ small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 80, ASP-1 range X100: | Read 80 CPM, ± 1 small div. |
| 21. MP 800, range X1K: | Read 800 CPM, ± 1 small div. |
| 22. MP 80K, range X100K: | Read 81K CPM, ± 1 small div. |
| 23. MP 800K, range X1M: | Read 930K cpm, ± 1 small div. |
| 24. MP 1.6M, range X10M: | Read 2.3M CPM, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | Leave 2 and 8 closed |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

Skip b (CPS) and go to d.

b. If CPS is to be used, preset and precalibrate as follows:

- | | |
|----------------------------|------------------------------------|
| 1. Meter label: | CPS |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 10 (2 and 8) |
| 4. Time switches: | Both MIN and HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP CPM: | 4K CPM |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 67 on meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--------------------------------|---|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Read 2K on range X10K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP CPM 40, ASP-1 range X1: | Read .67 CPS, ± 1 small div. |
| 21. MP 400, range X10: | Read 6.7 CPS, ± 1 small div. |
| 22. MP 40K, range X1K: | Read 670 CPS, ± 1 small div. |
| 23. MP 400K, range X10K: | Read 7.2K CPS, ± 1 small div. |
| 24. MP 1.6M, range X100K: | Read 37K CPS, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | Leave 2 and 8 closed |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

Skip c and go to d.

c. If Bq is to be used, preset and precalibrate as follows:

- | | |
|----------------------------|------------------------------------|
| 1. Meter label: | CPS |
| 2. Multiplier dial: | X100K-X1 |
| 3. Dead time switches: | 10 (2 and 8) |
| 4. Time switches: | Both MIN and HOUR open. |
| 5. Calibration switches: | 3 open, 4 closed. |
| 6. Speaker dividers: | 1 closed. All others open. |
| 7. HV output: | Not over 1000V |
| 8. ASP-1 range switch: | X100 |
| 9. Set MP cpm: | 2K cpm |
| 10. Set MP amplitude: | 10 mV |
| 11. Set GAIN pot: | Full cw |
| 12. Set THRESH pot: | Set at crossover point. |
| 13. Set MP amplitude: | 200 mV. Observe no count increase. |
| 14. Set MP amplitude: | 15 mV |
| 15. ASP-1 response switch: | SLOW |
| 16. ASP-1 CAL pot: | Set for 33 on meter. |

CAUTION: The standard current must not be below 0.42

- | | |
|--------------------------------|---|
| 17. ASP-1 response: | INTEGRATE. |
| 18. RESET, time for 30 sec: | Read 4K on range X10K, ± 1 small div. |
| 19. Response: | SLOW or FAST, as preferred. |
| 20. MP cpm 40, ASP-1 range X1: | Read 0.33 Bq, ± 1 small div. |
| 21. MP 400, range X10: | Read 3.3 Bq, ± 1 small div. |
| 22. MP 40K, range X1K: | Read 330 Bq, ± 1 small div. |
| 23. MP 400K, range X10K: | Read 3.6 Bq, ± 1 small div. |
| 24. MP 1.6M, range X100K: | Read 18K Bq, ± 1 small div. |
| 25. Close 32 dead time switch: | Over-range |
| 26. Open 32 dead time switch: | Leave 2 and 8 closed |
| 27. ASP-1: | OFF |
| 28. Disconnect MP | |

d. Calibration to Alpha Sources. Unless otherwise specified, use ^{230}Th sources.

1. Connect the SPA-1A to the ASP-1.
2. Expose the SPA-1A to a 10K to 60K CPM source. Set the ASP-1 to an appropriate range and find the end points of the voltage plateau. Set the HV accordingly, at about one quarter of the way up from the knee.
3. Using a source of approximately 8K cpm 2π , compute the efficiency of the detector by dividing the ASP-1 reading by the 2π source value (in CPM, CPS or Bq). The result must be greater than 0.60 for cpm or cps, 0.30 for Bq, for any isotope.
4. Repeat 3. with a source in the 80K cpm 2π range. The efficiency must be 0.60 for cpm or cps, 0.30 for Bq, or greater.
5. If the final calibration is to true detector count rate, record the range switch settings and the count rates (CPM, CPS or Bq) on the calibration certificate. Compute and record the percent efficiencies for all sources, regardless of the final calibration. (Percent efficiency = ASP-1 reading X100 divided by the 2π source value.) The minimum efficiency for each source is 60 percent. If calibration is to 4π efficiency (Bq or dps), use the source 4π value. The minimum 4π efficiency is 30 percent.
6. If the calibration is to true detector count rate, check the appropriate box (upper one) on the calibration certificate. Skip to number 12 below.
7. If the calibration is to 2π source value, check the appropriate box (lower one) on the calibration certificate. Connect the minipulser to the ASP-1.
8. Set the ASP-1 range switch to position 3. (Position 1 is fully CW.) Set the CPM output for a reading between mid and full scale.
9. Compute the average of the percent efficiencies on the calibration certificate and divide by 100 to get a decimal efficiency number.
10. Divide the ASP-1 reading of 8. above by the decimal efficiency. Do not change the minipulser frequency but calibrate the ASP-1 to read the higher count rate. Use the minimum possible settings of the cal switches, 3 and 4.

CAUTION: The standard current must not be below 0.42

11. Reconnect the detector and retake the readings from the sources listed on the calibration certificate. The readings must be within 10 percent of the 2π or 4π source values. Record the range switch settings and the readings on the calibration certificate.

12. Fill in the remaining blanks on the certificate. (The rate units blank is CPM or CPS.) Sign and date it.
13. Fill in the first line of the calibration record label in the ASP-1 can. In the units column, enter (1.) 2π CPM (or CPS) or (2.) TRUE CPM (or CPS), or 4π dps (or Bq) as appropriate. Record the ASP-1 S/N on the label.

F.17. HP-220A

1. Set the gain Control fully clock wise (CW).
2. Set the input sensitivity to 10 mV.
3. Set the high voltage to 600 Vdc.
4. With a nominal input sensitivity of 21 cpm/mR/h, the lowest range is as follows:

Units	mR/h	R/h
Lowest Range	X1	X.001

Adjust the range switch multiplier dial so that this is the lowest range multiplier visible, for the selected units.

5. Install the selected rate unit label in the holder.
6. Precalibrate the CAL switches and CAL potentiometer.

Set CALibration Switches switches 3 and 4 to "closed"

Standard current is $15.6/21 = 0.74$

Adjust the meter to read the standard current by,

Selecting FAST or SLOW

Setting the range switch to multiplier position

Pressing the RESET switch for 5 seconds

Adjust the CAL potentiometer to obtain the calculated value.

CAUTION: The standard current must not be below 0.42.

7. Set the dead time switches to 20 μ sec.

8. Expose the detector to the following fields:

Low exposure	75mR/h	Adjust the CAL control until the meter reads this value.
--------------	--------	--

High exposure	75 R/h	Adjust the DEAD TIME switches until the meter reads this value.
---------------	--------	---

Linearity	750 mR/h	The instrument must read these values ± 15 percent.
	7.5 R/h	
	75 R/h	

9. Over-range will be off scale.

APPENDIX A

ASP-1, no detector, and miscellaneous information.

- a. If no detector is specified and no detector information is available, set up the ASP-1 as if it were to be used with an HP-270. Obtain a HP-270 and perform the checkout procedure for ASP-1, HP-270, mR/h. Completely fill out the calibration certificate but write "Detector not included." on the certificate. Make sure the ASP-1 S/N is on the can label but do not enter any other information on the label.
- b. If PHA is ordered, but no detector information is available, set it up for CPM. Follow the preset and precalibrate instructions in F.2.a. Fill out the ASP-1, PHA, SPA-3 calibration certificate as far as possible, omitting the detector response data. Write "Detector not included." on the certificate. Make sure the ASP-1 S/N is on the can label but do not enter any other information on the label.
- c. If PHA is ordered, along with a non-PHA type detector, (GM, NRD, etc.), follow paragraph f. below. Then set the PHA-GROSS switch to GROSS and calibrate normally, according to the procedure for the detector.
- d. If no detector is ordered, but information is available as to the first detector to be used, preset and precalibrate according to the instructions for that detector. Fill out the corresponding calibration certificate, as far as possible, omitting the detector response data. Write "Detector not included." on the certificate. Make sure the ASP-1 S/N is on the can label but do not enter any other information on the label.
- e. If a main PC board assembly only is ordered, make sure it has been checked per 10429-A394.
- f. If a PHA board assembly only is ordered, plug it into an operational ASP-1.
 1. PHA-Gross switch: GROSS
 2. ASP-1 range switch: Position 3. (Position 1 is fully cw.)
 3. Set MP CPM: For mid scale or higher indication.
 4. Set MP amplitude: 10 mV
 5. Set THRESH pot: Full cw
 6. Set GAIN pot: Set at crossover point.
 7. Set WIN pot: Full cw
 8. Set PHA-GROSS: PHA
 9. Set MP amplitude: Set at crossover point, top of window. MP amplitude to be between 18 and 22 mV.
 10. Set MP amplitude: 1.5 V. Observe no counts.

Do not include a calibration certificate.

DEAD TIME SWITCH TABLE

(All switches not shown closed (c) must be opened).															
DT	DEAD TIME SWITCHES							DT	DEAD TIME SWITCHES						
	2	4	8	16	32	64	128		2	4	8	1 6	3 2	6 4	128
2	c							66	c					c	
4		c						68		c				c	
6	c	c						70	c	c				c	
8			c					72			c			c	
10	c		c					74	c		c			c	
12		c	c					76		c	c			c	
14	c	c	c					78	c	c	c			c	
16				c				80				c		c	
18	c			c				82	c			c		c	
20		c		c				84		c		c		c	
22	c	c		c				86	c	c		c		c	
24			c	c				88			c	c		c	
26	c		c	c				90	c		c	c		c	
28		c	c	c				92		c	c	c		c	
30	c	c	c	c				94	c	c	c	c		c	
32					c			96					c	c	
34	c				c			98	c				c	c	
36		c			c			100		c			c	c	
38	c	c			c			102	c	c			c	c	
40			c		c			104			c		c	c	
42	c		c		c			106	c		c		c	c	
44		c	c		c			108		c	c		c	c	
46	c	c	c		c			110	c	c	c		c	c	
48				c	c			112				c	c	c	
50	c			c	c			114	c			c	c	c	
52		c		c	c			116		c		c	c	c	
54	c	c		c	c			118	c	c		c	c	c	
56			c	c	c			120			c	c	c	c	
58	c		c	c	c			122	c		c	c	c	c	
60		c	c	c	c			124		c	c	c	c	c	
62	c	c	c	c	c			126	c	c	c	c	c	c	

64						c			128							c
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DEAD TIME SWITCH TABLE

(All switches not shown closed (c) must be opened).															
DT	DEAD TIME SWITCHES							DT	DEAD TIME SWITCHES						
	2	4	8	16	32	64	128		2	4	8	1 6	3 2	6 4	128
130	c						c	194	c					c	c
132		c					c	196		c				c	c
134	c	c					c	198	c	c				c	c
136			c				c	200			c			c	c
138	c		c				c	202	c		c			c	c
140		c	c				c	204		c	c			c	c
142	c	c	c				c	206	c	c	c			c	c
144				c			c	208				c		c	c
146	c			c			c	210	c			c		c	c
148		c		c			c	212		c		c		c	c
150	c	c		c			c	214	c	c		c		c	c
152			c	c			c	216			c	c		c	c
154	c		c	c			c	218	c		c	c		c	c
156		c	c	c			c	220		c	c	c		c	c
158	c	c	c	c			c	222	c	c	c	c		c	c
160					c		c	224					c	c	c
162	c				c		c	226	c				c	c	c
164		c			c		c	228		c			c	c	c
166	c	c			c		c	230	c	c			c	c	c
168			c		c		c	232			c		c	c	c
170	c		c		c		c	234	c		c		c	c	c
172		c	c		c		c	236		c	c		c	c	c
174	c	c	c		c		c	238	c	c	c		c	c	c
176				c	c		c	240				c	c	c	c
178	c			c	c		c	242	c			c	c	c	c
180		c		c	c		c	244		c		c	c	c	c
182	c	c		c	c		c	246	c	c		c	c	c	c
184			c	c	c		c	248			c	c	c	c	c
186	c		c	c	c		c	250	c		c	c	c	c	c
188		c	c	c	c		c	252		c	c	c	c	c	c

190	c	c	c	c	c		c		254	c	c	c	c	c	c	c
192						c	c									